INDUSTRIALIZE YOUR ROM COOKING: Good practices

AGENDA

GENYMOBILE
Let IT be mobile

01

What's this?

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Create your device

04

Adapt Android

PROFESSIONAL ROM

What's this ?

PROFESSIONAL ROM

What's this ?

Let IT be mobile

For professionals

Specific core business features

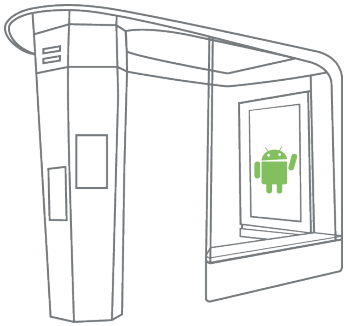
High quality requirements

PROFESSIONAL ROM

Why Android ?

genymobile
Let IT be mobile

- Open Source with AOSP
- After 4 years : 80% market share
- Sustainable solution
- Multiple targets



PROFESSIONAL ROM

Good practices ?

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- Android is a very recent OS
- Android/Linux ≠ GNU/Linux

We have seen all the presented examples in production

A GOOD START

Starts with sane basis

A GOOD START

Howto to build ?

Let IT be mobile

```
> source build/envsetup.sh

> lunch

> make -j42
```

A GOOD START

lunch menu

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```
You're building on Linux

Lunch menu... pick a combo:
     1. aosp_arm-eng
     2. aosp_x86-eng
     3. aosp_mips-eng
     4. vbox_x86-eng
     5. vbox86p-userdebug
     6. vbox86p-eng
     7. vbox86t-userdebug
     8. vbox86t-eng
     9. vbox86tp-userdebug
     10. vbox86tp-eng
     11. aosp_deb-userdebug
     12. aosp_flo-userdebug
     13. aosp_grouper-userdebug
     14. aosp_tilapia-userdebug
     15. mini_armv7a_neon-userdebug
     16. mini_mips-userdebug
     17. mini_x86-userdebug
     18. aosp_hammerhead-userdebug
     19. aosp_mako-userdebug
     20. aosp_manta-userdebug

Which would you like? [aosp_arm-eng] 9

============================================
PLATFORM_VERSION_CODENAME=REL
PLATFORM_VERSION=4.4.2
TARGET_PRODUCT=vbox86tp
TARGET_BUILD_VARIANT=userdebug
TARGET_BUILD_TYPE=release
TARGET_BUILD_APPS=
TARGET_ARCH=x86
TARGET_ARCH_VARIANT=x86
TARGET_CPU_VARIANT=
HOST_ARCH=x86
HOST_OS=linux
HOST_OS_EXTRA=Linux-3.11.0-19-generic-x86_64-with-Ubuntu-13.10-saucy
HOST_BUILD_TYPE=release
BUILD_ID=KOT49H
OUT_DIR=out
============================================
```

A GOOD START

Sources organization 1/4

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bionic/	Android LibC
bootable/	Bootloader & recovery
build/	The build system
cts/	Compatibility Test Suite : the certification test suite

A GOOD START

Sources organization 2/4

Let IT be mobile

developement/	Developement tools
device/	Device specific files
external/	External librairies & applications
frameworks/	The Android framework

A GOOD START

Sources organization 3/4

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libcore/	Java implementation (Apache Harmony)
ndk/	Native Development Kit
out/	Compilation results
packages/	Android base applications

A GOOD START

Sources organization 4/4

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prebuilt/	Precompiled binaries (toolchain, gdbserver…)
sdk/	Software developement kit
system/	Android system tools: init, toolbox, logcat...
vendor/	Vendor directory (libs, apps)

A GOOD START

Version management

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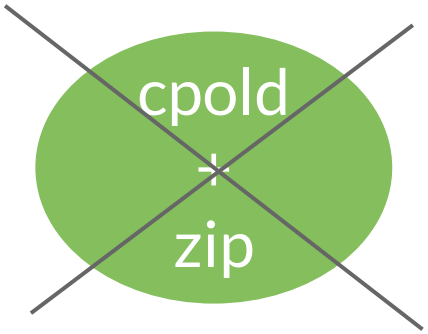

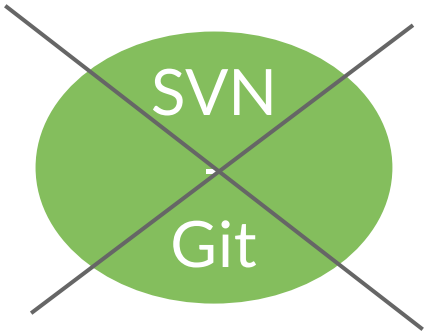

REPO !!

A GOOD START

What about the hardware ?

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A professional device, it's a whole thing

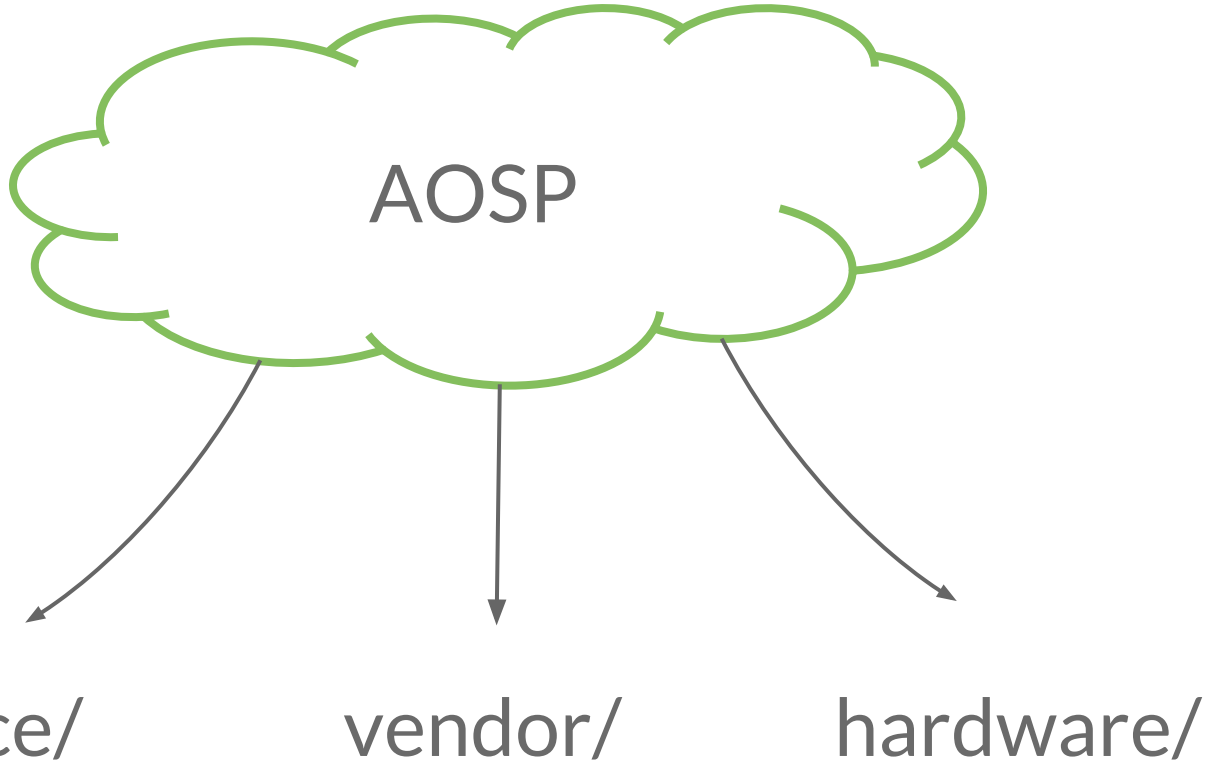
Work on a ROM depend a lot of the hardware

Depending on the hardware, the same ROM can require a lot more work to be less complete

CREATE YOUR DEVICE

CREATE YOUR DEVICE

Add support for a device



CREATE YOUR DEVICE

Manufacturing the target

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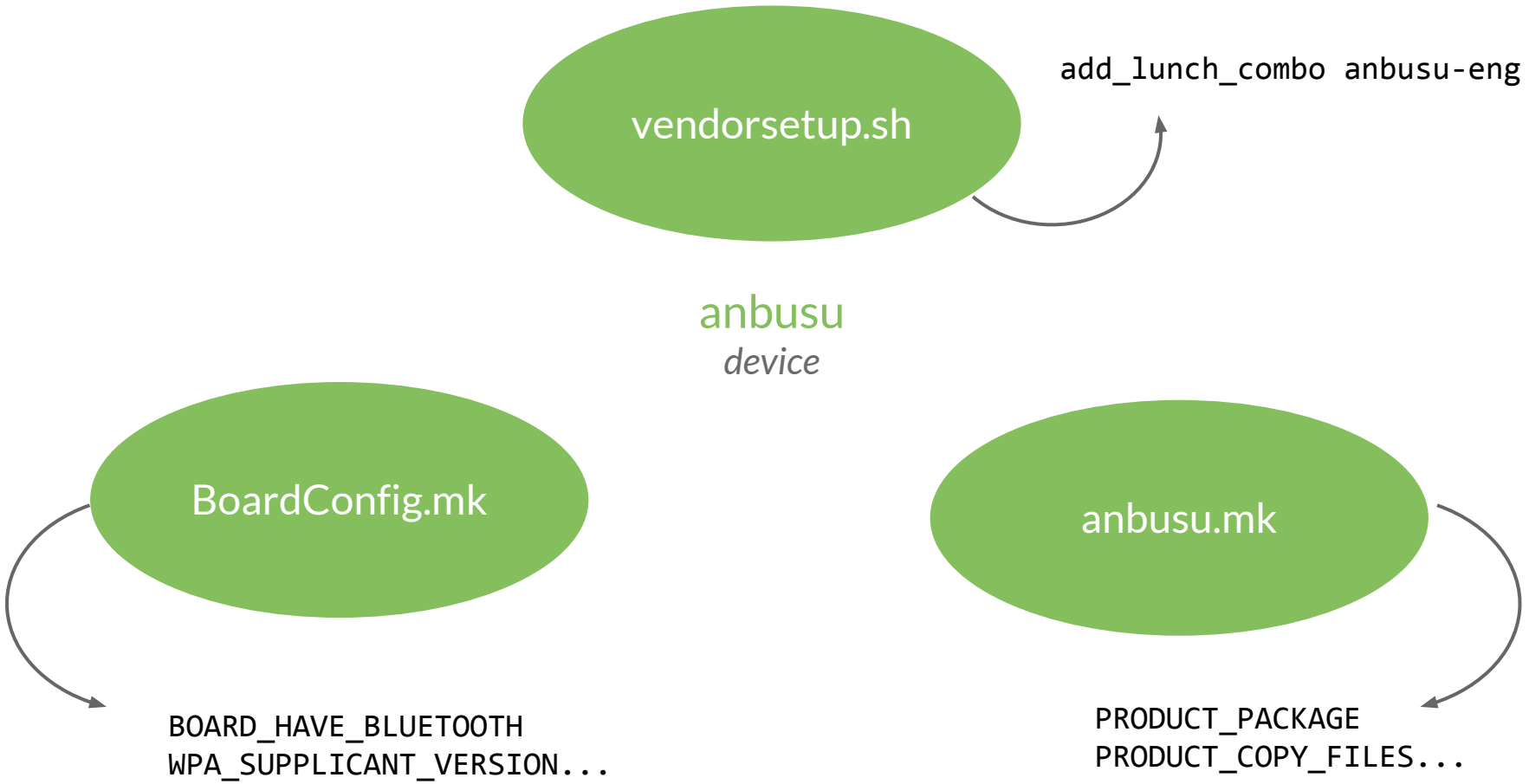
In device/$(BRAND)/$(MODEL) :



CREATE YOUR DEVICE

device/$(BRAND)/$(MODEL)/BoardConfig.mk

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```
# BoardConfig.mk

PRODUCT_MANUFACTURER := Genymobile
TARGET_ARCH=x86
BUILDROID_X86_NOSSE2 := true
TARGET_CPU_SMP := true
DISABLE_DEXPREOPT := true
TARGET_COMPRESS_MODULE_SYMBOLS := false
TARGET_NO_RECOVERY := true

...
```

CREATE YOUR DEVICE

device/$(BRAND)/$(MODEL)/$(TARGET).mk

genymobile
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```
# anbusu.mk

$(call inherit-product,\ device/genymobile/genydemo/device.
mk)

$(call inherit-product,\
$(SRC_TARGET_DIR)/product/aosp_base.mk)

PRODUCT_NAME := aosp_anbusu
PRODUCT_DEVICE := anbusu
PRODUCT_BRAND := genybrand
PRODUCT_MODEL := AOSP on Android Builder Summit
PRODUCT_MANUFACTURER := genymanufacturer
```

CREATE YOUR DEVICE

device/$(BRAND)/$(MODEL)/device.mk

genymobile
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```
# device.mk

PRODUCT_PACKAGES += \
    anbusuapp

PRODUCT_COPY_FILES += \
    device/genymobile/genydemo/init.paug.rc : root/init.anbusu.rc

PRODUCT_PROPERTY_OVERRIDES += \
    ro.genytruc=genyvalue

PRODUCT_DEFAULT_PROPERTY_OVERRIDES +=\
   ro.genydream = genyvalue
```

CREATE YOUR DEVICE

device/$(BRAND)/$(MODEL)/device.mk

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```
DEVICE_PACKAGE_OVERLAYS += \
device/genymobile/genydemo/overlay

# the actual meat of the device-specific product definition
$(call inherit-product, \
device/genymobile/anbusubase/device-common.mk)

# inherit from the non-open-source side, if present
$(call inherit-product-if-exists, \
vendor/genymobile/genycusto/device-vendor.mk)
```

CREATE YOUR DEVICE

Customize Android

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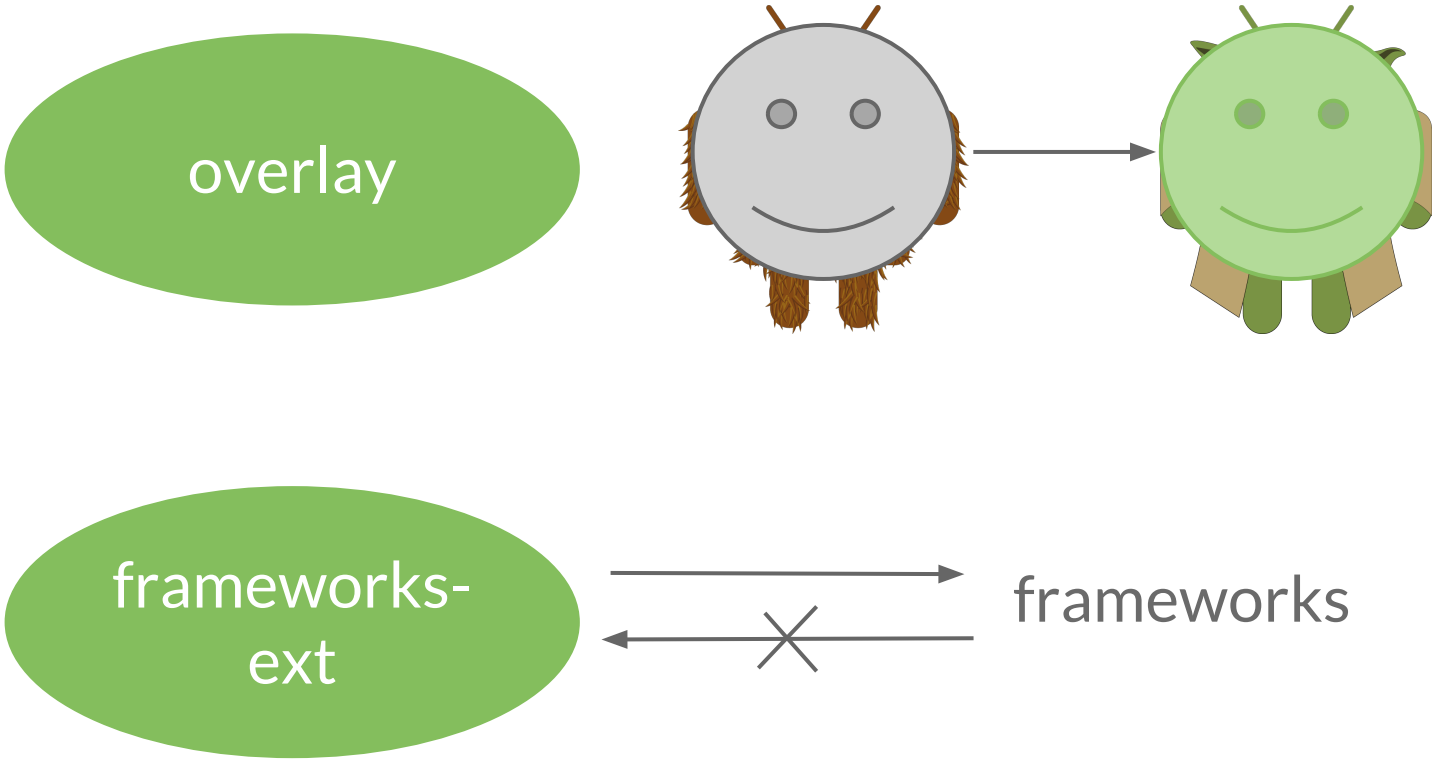
In device/$(BRAND)/$(MODEL) :



Hardware support

Specific to a component

(vs device)

We often have binaries in vendor/ because sources are often proprietaries

ADAPT ANDROID

From bottom to top

Adapt ANDROID

First: the kernel

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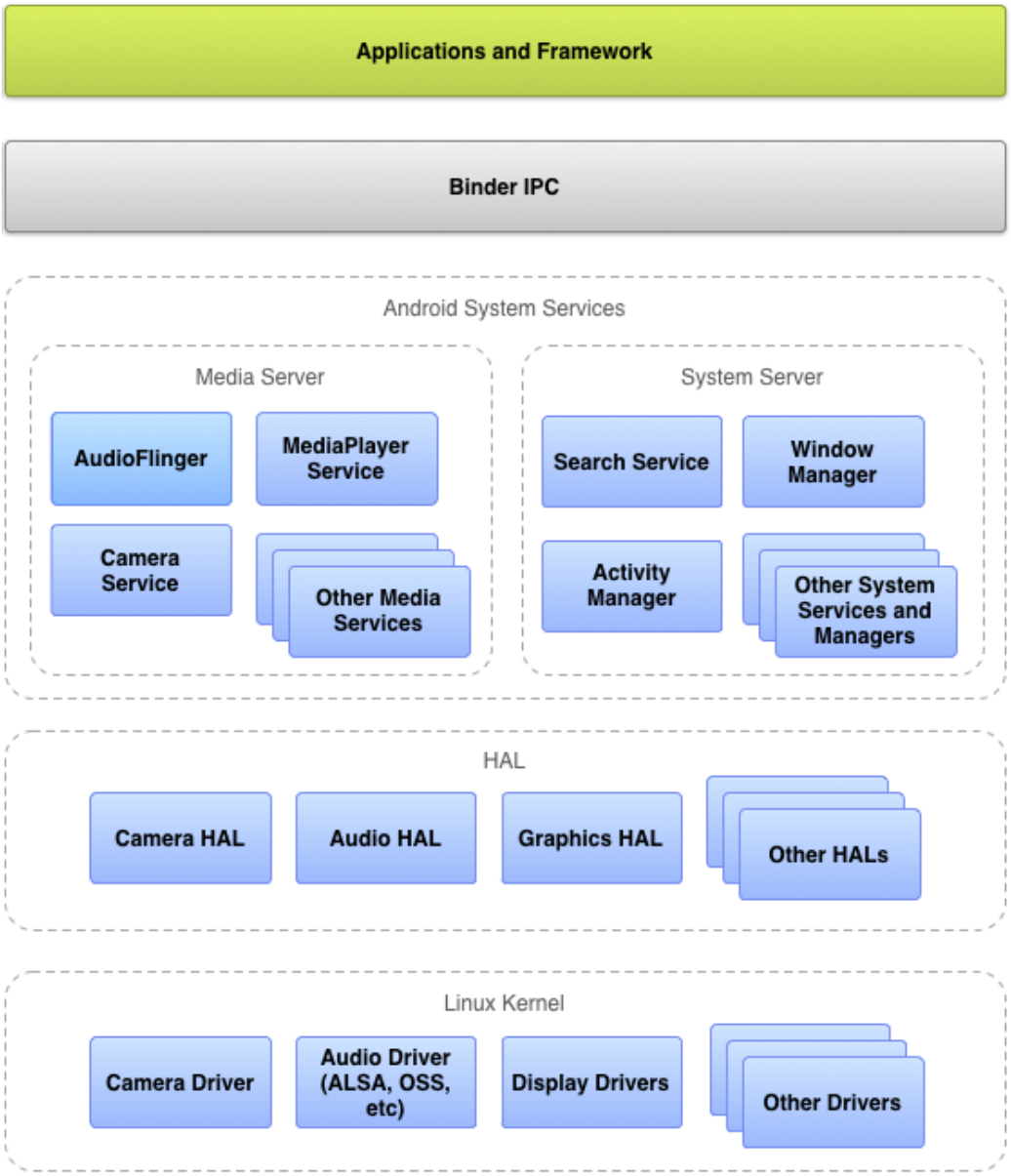

Adapt ANDROID

init dev

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 # in init.rc

```
on boot
   insmod /system/lib/modules/anbusu.ko
   chown system system /dev/anbusu
   chmod 0600 /dev/anbusu
```

 # in ./device/<vendor>/<product>/device.mk

```
PRODUCT_COPY_FILES := \
device/<vendor>/<product>/anbusu.ko:
system/lib/modules/anbusu.ko
```

Adapt ANDROID

/dev/anbusu test

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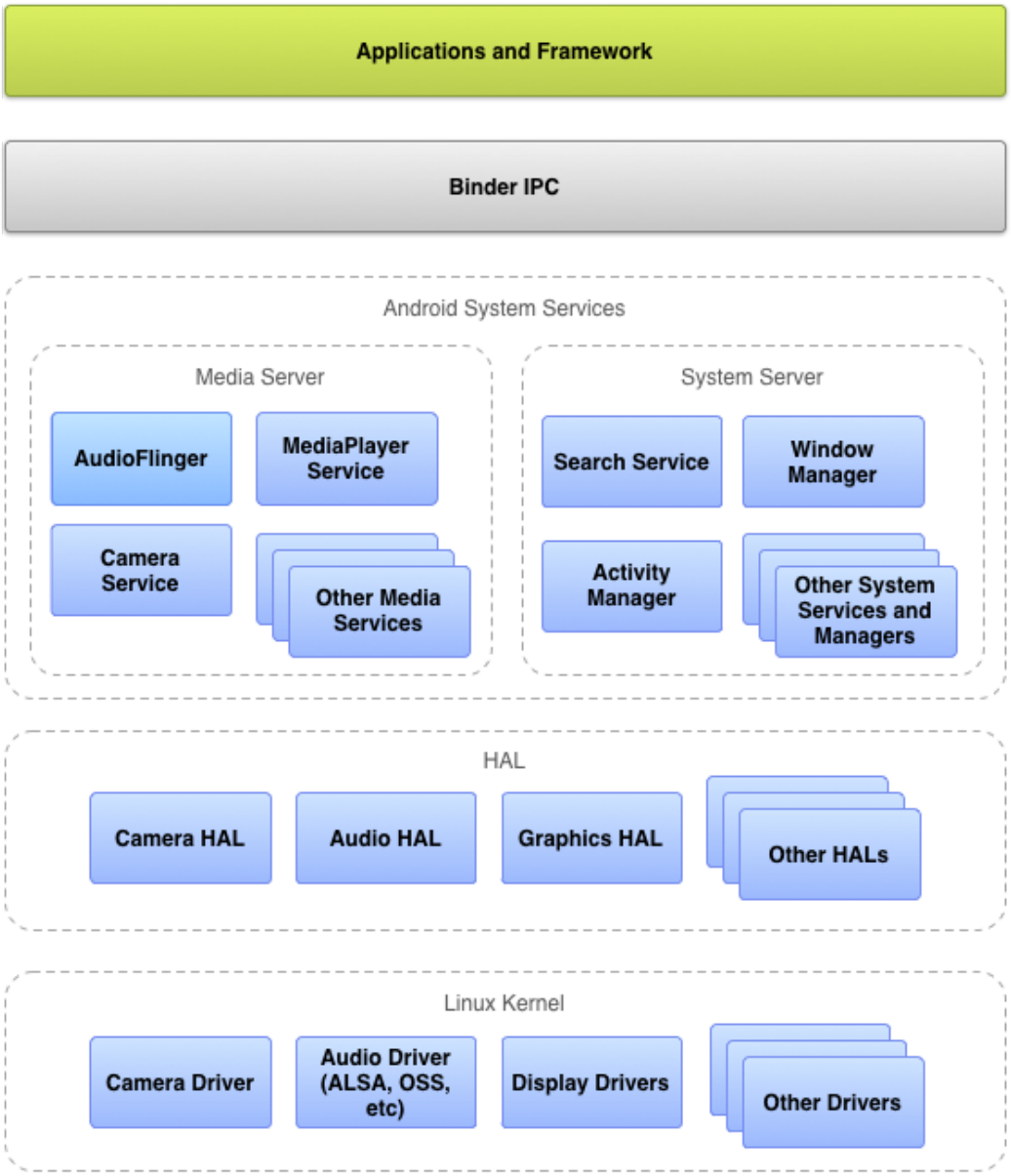
```
adb shell

# ls -l /dev/anbusu
crw------- system  system  249,  0 anbusu

# echo Hello > /dev/anbusu

# cat /dev/anbusu
hELLO

#
```

Adapt ANDROID

Low-level libs



Adapt ANDROID

hardware/anbusu/lib

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 # in libanbusu.h

```
ssize_t anbusu_getdata(void *buf, size_t count);
ssize_t anbusu_putdata(const void *buf, size_t count);
void anbusu_clear(void);
```

#This is where you have to put all the complex code (and it's close source most of the time)

Adapt ANDROID

Dig in the framework

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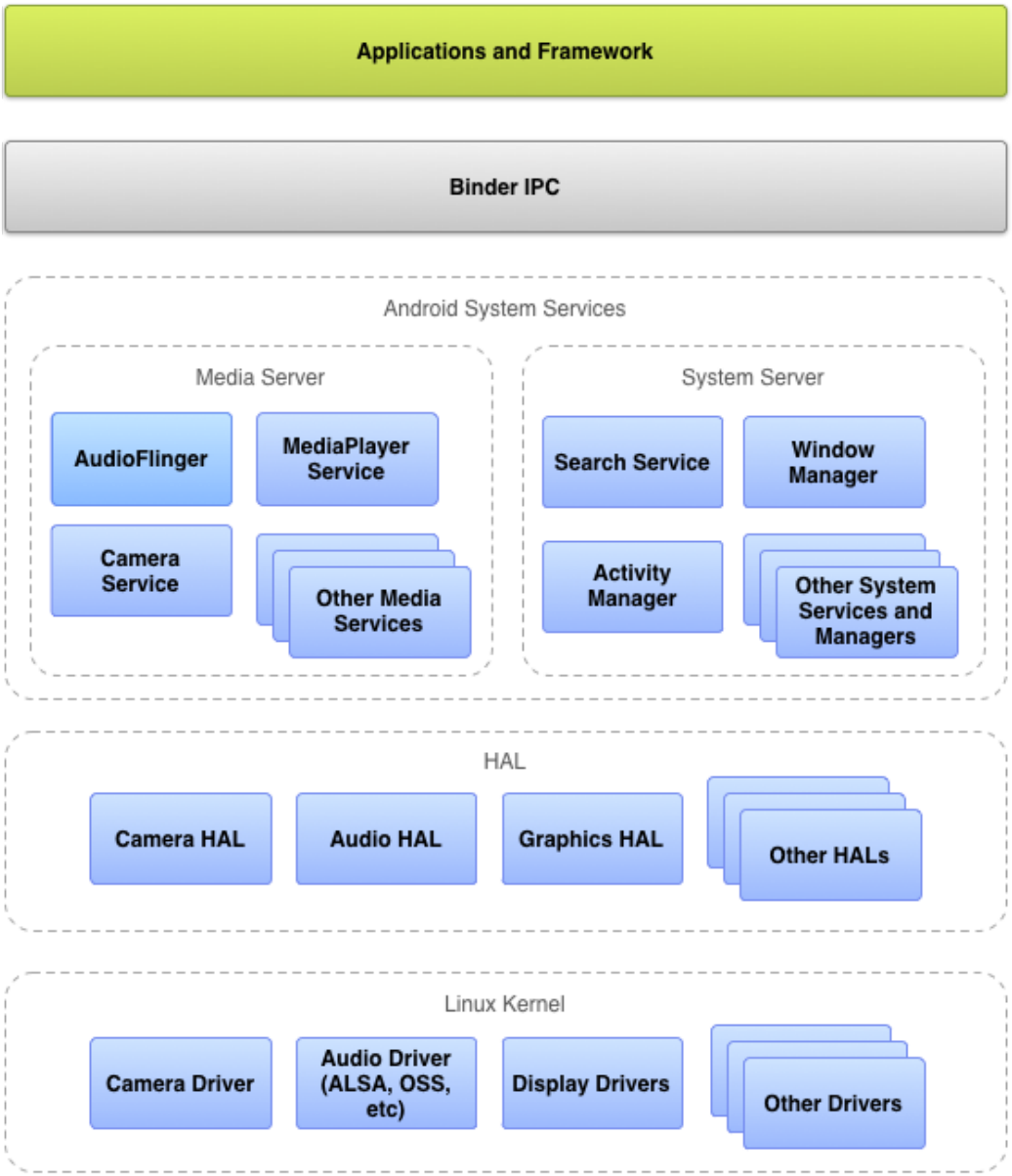

Adapt ANDROID

frameworks/base/core/java/android/anbusu/

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#LibAnbusu.java

```
package android.anbusu;

public class LibAnbusu {

    public native static void clear();
    public native static String getData()
                                throws AnbusuException;
    public native static void putData(String in)
                                throws AnbusuException;

    static {
            System.loadLibrary("anbusu_jni");
    }
}
```

Adapt ANDROID

hardware/anbusu/jni/

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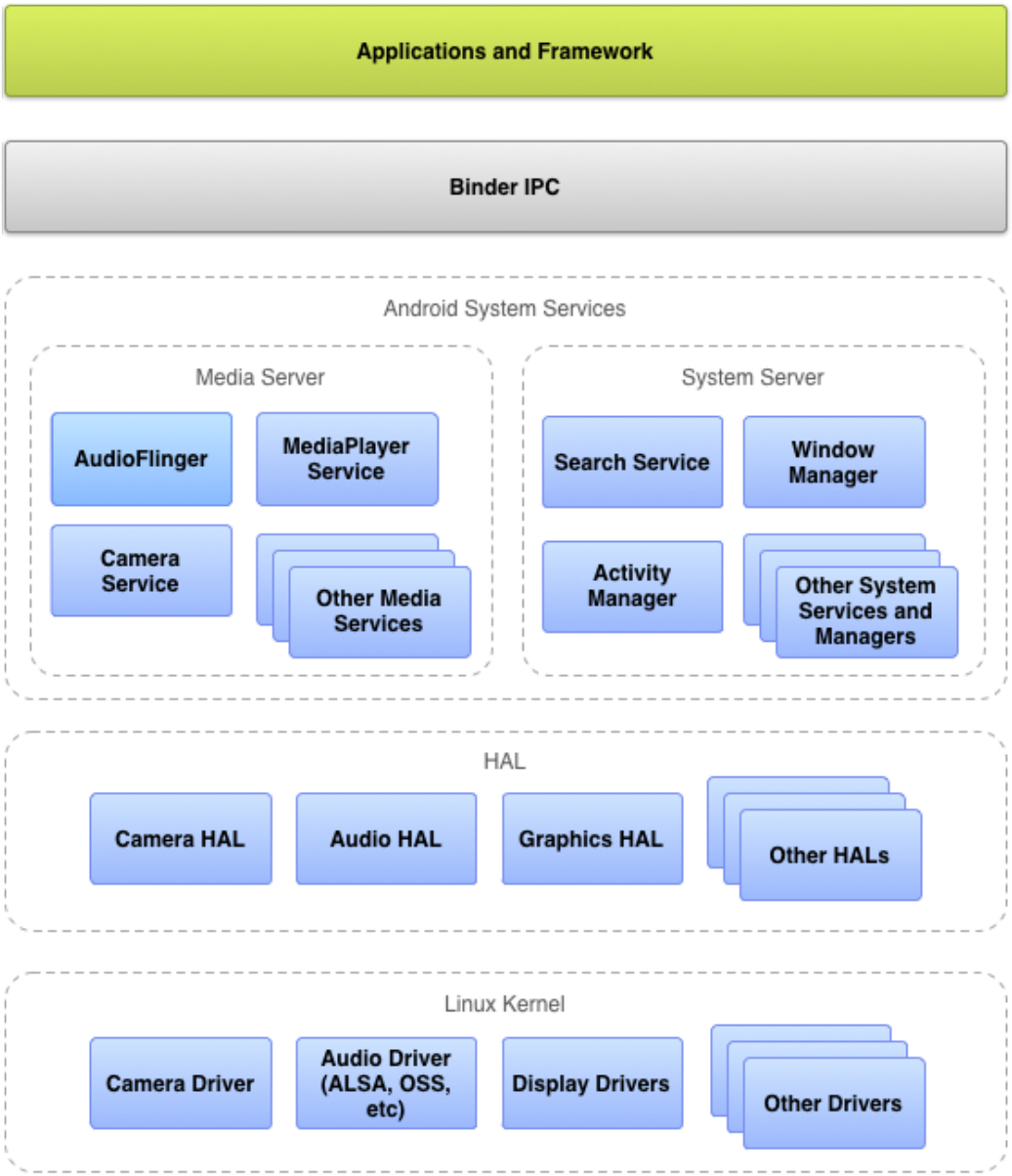
#android_anbusu_LibAnbusu.c

```
JNIEXPORT void JNICALL
Java_android_anbusu_LibAnbusu_putData(JNIEnv *env,
                                      jclass cls,
                                      jstring string)
{
    int ret;
    const char *buff =
           (*env)->GetStringUTFChars(env, string, NULL);
    int length = (*env)->GetStringLength(env, string);
    ret = anbusu_putdata(buff, length);
    if (ret < 0) {
        ThrowAnbusuException(env, "fail to put data");
    }
    (*env)->ReleaseStringUTFChars(env, string, buff);
}
```

Adapt ANDROID

Still in the framework



Adapt ANDROID

framework/base/anbusu/java/android/anbusu/

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#IAnbusuManager.aidl

```
package android.anbusu;
/** {@hide} */
interface IAnbusuManager
{
   void clear();
   String getData();
   void putData(String data);
}
```

Adapt ANDROID

frameworks/base/services/java/com/android/server/

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#AnbusuService.java

```
class AnbusuService extends IAnbusuManager.Stub {

    public String getData() {
            enforceAccessPermission();
            try {
                return LibAnbusu.getData();
            } catch(AnbusuException e) {
                Slog.d(TAG, "cannot getdata");
            }
            return null;
    }
    ...
    private void enforceAccessPermission() { … }
}
```

Adapt ANDROID

Hacking SystemServer.java

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#SystemServer.java

```
...
public void run() {
...
try {
    Slog.i(TAG, “Android Builder Summit Service");
    anbusuService = new AnbusuService(context);

    ServiceManager.addService(Context.PAUG_SERVICE,
                              anbusuService);
} catch (Throwable e) {
    reportWtf("starting Android Builder Summit Service",
e);
}
...
```

Adapt ANDROID

And even more ...

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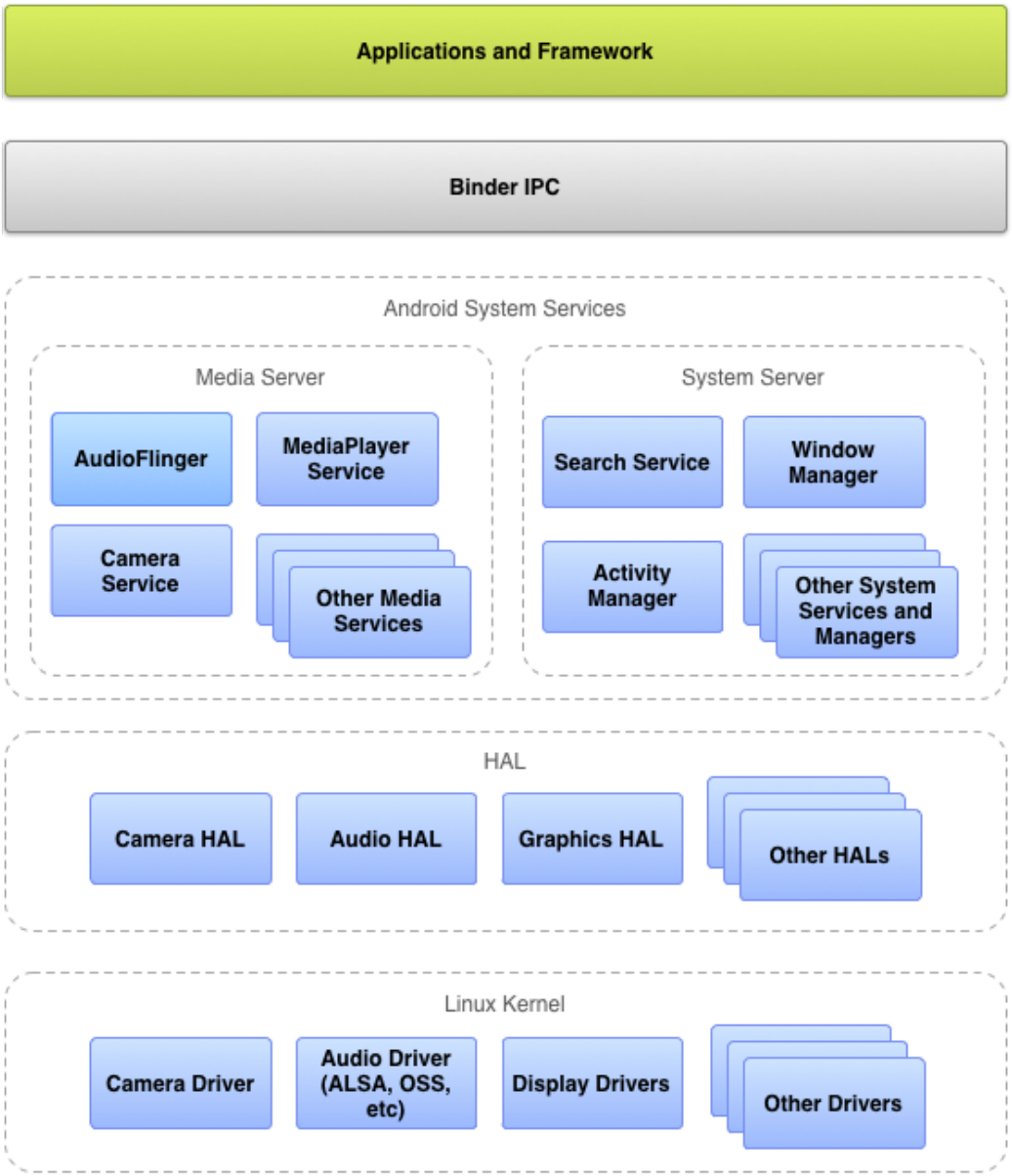

Adapt ANDROID

framework/base/anbusu/java/android/anbusu

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AnbusuManager.java

```
public class AnbusuManager {
    IAnbusuManager mService;

    public AnbusuManager(IAnbusuManager service) {
            mService = service;
    }

    public String getData() {
            try {
                return mService.getData();
            } catch (RemoteException e) {
                e.printStackTrace();
            }
            return null;
    }
}
```

Adapt ANDROID

Hacking ContextImpl.java

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AnbusuManager.java

```
class ContextImpl extends Context {

   static {
        ...

        registerService(ANBUSU_SERVICE,
        new ServiceFetcher() {
                public Object createService(ContextImpl ctx){
                    IBinder b = ServiceManager
                                .getService(ANBUSU_SERVICE);
                    IAnbusuManager service =
                        IAnbusuManager.Stub.asInterface(b);
                    return new AnbusuManager(service);
                }});
}
...
```

Adapt ANDROID

make update-api ; make sdk

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We are now able to

BUILD

OUR SDK

and configure our IDE

Adapt ANDROID

Now the application

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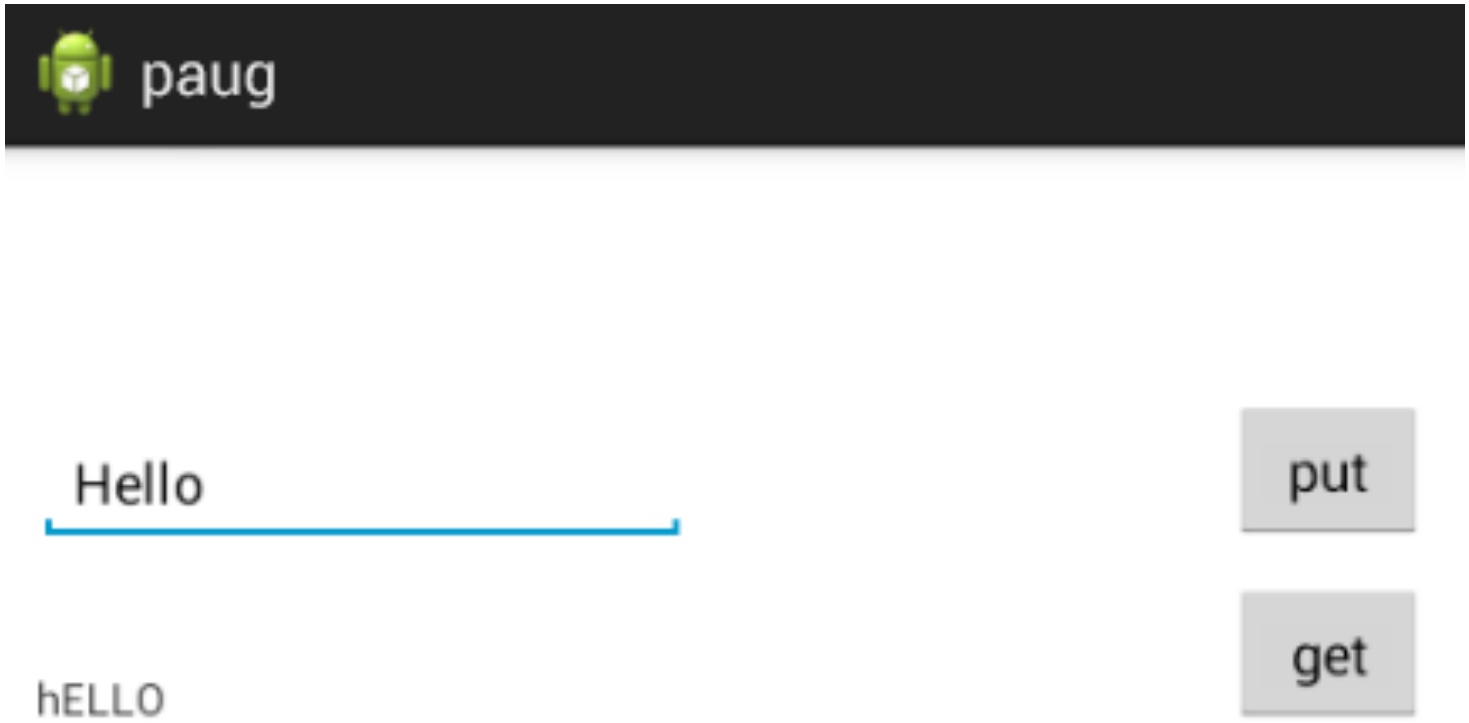
```
AnbusuManager anbusuManager;


anbusuManager =
(AnbusuManager) this.getSystemService(ANBUSU_SERVICE);

anbusuManager.putData(“Hello Android Builder Summit!”);
```

Adapt ANDROID

TADAM !



WHY DOES IT MATTERS ?

Get your boss/client/girlfriend happy

WHY DOES IT MATTERS ?

Make everybody happy

Let IT be mobile

Think maintenance

Keep complexity in mind

And never ever forget that the maintenance work is a C_n^p and the more you add possibilities the more you increase the maintenance costs